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Research Article

Knowledge, Prevention and Preparedness for the Management of Cardiac Arrest in Senegalese Professional Football: A Study Among Ligue 1 and Ligue 2 Clubs

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Abstract

Sudden cardiac arrest (SCA) is the leading medical cause of death in athletes during sport. In football, survival depends largely on immediate cardiopulmonary resuscitation (CPR) and early defibrillation, yet data on emergency preparedness in African professional football remain scarce. This study aimed to assess knowledge, preventive measures and preparedness for SCA management among coaches, medical staff and players of Senegalese Ligue 1 and Ligue 2 clubs. A descriptive cross-sectional survey was conducted in ten clubs (five Ligue 1, five Ligue 2) during the 2024–2025 season. Group-specific structured questionnaires were completed by 10 coaches, 3 medical staff members and 30 players, and covered risk perception, knowledge, pre-participation screening, CPR and automated external defibrillator (AED) training, and AED availability. Data were analysed with descriptive statistics. Most coaches (80%) knew of SCA cases in football, but only 20% had been trained to recognise and manage SCA, none were regularly re-tested on emergency protocols, and 50% reported no preventive measures in their club. Nine of ten coaches and two of three medical staff members reported that an AED was never available during training or matches. Among players, 96.4% reported being aware of SCA risk, yet only 35.7% could identify its main risk factors, 25.9% had received first-aid/AED training and 22.2% reported pre-participation electrocardiogram (ECG) screening in their club. Support for regular cardiac screening was almost unanimous in all groups. Awareness of SCA in Senegalese professional football contrasts with weak operational readiness. Mandatory pre-participation cardiovascular screening, regular CPR/AED training for all stakeholders, and an AED with a rehearsed emergency action plan at every stadium and training ground should be prioritised.

Keywords

Sudden Cardiac Arrest, Football, Pre-Participation Screening, Automated External Defibrillator, Cardiopulmonary Resuscitation, Emergency Preparedness, Sports Medicine, Senegal

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1. Introduction

Football is the most widely played sport in the world. Match play combines prolonged aerobic work with repeated high-intensity actions: elite players cover approximately 10-12 km per match at mean heart rates of about 80-90% of maximal heart rate, interspersed with sprints, accelerations and changes of direction [1]. The resulting haemodynamic and autonomic stress (tachycardia, rise in blood pressure, catecholamine surge, dehydration and electrolyte shifts) may trigger malignant ventricular arrhythmias in players with undiagnosed structural or electrical heart disease [2, 3].

Sudden cardiac arrest (SCA), the abrupt loss of effective cardiac mechanical activity with immediate interruption of blood flow to vital organs, is the leading medical cause of death in athletes during sport [3]. Reported incidence varies with the population studied and the methodology, from about 1 in 53,700 athlete-years among United States collegiate athletes [4] to lower estimates in registry-based studies [5]. A 20-year analysis of National Collegiate Athletic Association athletes (2002-2022) reported an overall incidence of about 1 in 63,700 athlete-years, a decline over time and an almost threefold higher incidence in Black than in White athletes [6]. In young athletes, SCA is mostly associated with cardiomyopathies (particularly hypertrophic cardiomyopathy), coronary artery anomalies, myocarditis and inherited arrhythmia syndromes, whereas coronary artery disease predominates after 35 years of age [2, 3, 7]. In the FIFA Sudden Death Registry, which collected 617 cases from 67 countries between 2014 and 2018, only 23% of players survived; survival reached 85% when CPR was combined with AED use, compared with 35% without an AED [7].

High-profile events, such as the death of Cameroonian midfielder Marc-Vivien Foé from previously undetected hypertrophic cardiomyopathy during the 2003 FIFA Confederations Cup and the survival of Danish player Christian Eriksen thanks to immediate CPR and defibrillation at UEFA Euro 2020, have raised global awareness of this issue. International bodies recommend pre-participation cardiovascular evaluation including a 12-lead ECG [8, 9], and FIFA's "11 steps" call for annual CPR/AED training of staff, an AED at every match and a rehearsed emergency action plan [10]. Written emergency plans with on-site AEDs are associated with high survival rates [11], and the Italian national screening programme was followed by an 89% decline in sudden cardiovascular death among young competitive athletes [12].

Evidence from Africa, however, remains scarce. A recent survey of 745 stakeholders in Cameroonian professional football reported poor SCA knowledge in about two-thirds of respondents and very low AED availability at matches [13]. In Senegal, the death in May 2025 of the 30-year-old captain of US Ouakam, who collapsed in the dressing room at half-time of a Ligue 1 match, was followed by public statements from the club physician that most clubs had neither a medicalised ambulance nor a defibrillator [14]. To our knowledge, no study has evaluated SCA preparedness in Senegalese professional football. This study therefore aimed to assess the knowledge, preventive measures and preparedness for SCA management of coaches, medical staff and players of Senegalese Ligue 1 and Ligue 2 clubs.

2. Materials and Methods

2.1. Study Design and Setting

A descriptive cross-sectional survey was conducted among clubs of the Senegalese professional league during the 2024-2025 season. Ten clubs located in different regions of the country were selected by convenience, according to accessibility: five Ligue 1 clubs (Linguère de Saint-Louis, Teungueth FC, ASC Jaraaf, Génération Foot and Casa Sports) and five Ligue 2 clubs (AS Saloum, Stade de Mbour, US Gorée, Diambar and CNEPS of Thiès). Data were collected between June 2024 and June 2025; participants were recruited during on-site visits to each club over this same period, each club being visited once.

2.2. Participants

Three groups of stakeholders were targeted in each club: the head coach, one member of the medical staff and ten players (expected totals: 10 coaches, 10 medical staff members and 100 players). Participants were recruited by non-probability convenience sampling based on availability and voluntary participation. The final sample comprised 10 coaches (five per league), 3 medical staff members and 30 players. Eligible participants were: (i) for coaches, the head coach of each selected club during the 2024-2025 season; (ii) for medical staff, a health professional belonging to the club's medical staff (physician, nurse or other health professional); and (iii) for players, footballers registered in the club's squad for the 2024-2025 season and present at the training session on the day of the visit. Individuals who were absent on the day of the visit, who declined to participate or who did not give informed consent were excluded; no exclusion was made on the basis of age, playing position or level of play.

2.3. Questionnaires and Data Collection

Three group-specific structured questionnaires were developed in French for coaches (15 items), medical staff (16 items) and players (13 items). They consisted mainly of closed questions with a few open questions and covered six domains: (i) sociodemographic and professional characteristics; (ii) perception of SCA risk; (iii) knowledge of SCA cases, risk factors and management protocols; (iv) existing preventive measures, including pre-participation screening; (v) CPR, first-aid and AED training; and (vi) AED availability during

training and matches. The questionnaires were reviewed by an expert in sport sciences (study supervisor) and pretested with ten players before use. The questionnaires were self-completed by participants on site at the clubs' training grounds, in the presence of the investigator. For participants with limited proficiency in French, administration was interviewer-assisted: the investigator read and explained the questions orally in Wolof, and the participant chose the answer, which was recorded in French. All responses were then entered into an electronic form by the investigator. Open-ended items (details of "yes" answers, such as names of known SCA cases or risk factors, opinions on the role of the media, sports organisations and coaches in awareness, and free suggestions) were few and brief; they were read by the investigator and used only qualitatively to illustrate the closed responses, and were not coded or included in the quantitative analysis.

2.4. Data Analysis

Responses were analysed using descriptive statistics (absolute frequencies and percentages). Before analysis, the electronic dataset was checked against the completed questionnaires. Each participant completed a single questionnaire during one visit; records were checked for duplicates (same club, same group and identical response pattern), and none was found. Responses were checked for internal consistency (for example, "if yes, specify" answers against the corresponding closed item) and for out-of-range values. Incomplete questionnaires were retained, and missing answers were not imputed. Because some players did not answer every item, percentages were calculated on the number of valid responses for each item, and the corresponding denominators are reported. Given the small sample sizes, no inferential testing was performed.

2.5. Ethical Considerations

The study was conducted in accordance with the principles of the Declaration of Helsinki. Participation was voluntary, and written informed consent was obtained from all participants before data collection. All data were collected anonymously and treated confidentially. No ethics committee approval was obtained for this anonymous, non-interventional questionnaire survey, which involved no clinical procedure and collected no identifying or health data.

3. Results

3.1. Participants

All coaches were men; 80% were aged 30–50 years and 90% had at least five years of coaching experience (Table 1). Only three medical staff members responded: one sports physician and two other health professionals; no cardiologist, emergency physician or nurse was represented. Thirty of the 100 targeted players returned the questionnaire; valid answers ranged from 27 to 29 per item. Half of the players were aged 18–25 years and most (89.3%) played at professional level.

Table 1. *Characteristics of participants.*

Group	Variable	Category	n (%)
Coaches (n=10)	Sex	Male	10 (100)
	Age	< 30 years	1 (10)
		30–40 years	4 (40)
		41–50 years	4 (40)
		> 50 years	1 (10)
	Coaching experience	< 5 years	1 (10)
		5–10 years	4 (40)
		11–20 years	5 (50)
	League	Ligue 1	5 (50)
		Ligue 2	5 (50)
Medical staff (n=3)	Sex	Male	3 (100)
	Age	< 30 years	1 (33.3)
		> 50 years	2 (66.7)
	Specialty	Sports physician	1 (33.3)
		Other health professional	2 (66.7)

Group	Variable	Category	n (%)
Players (n=30)	Age (N=28)	< 18 years	3 (10.7)
		18–25 years	14 (50.0)
		26–35 years	9 (32.1)
		> 35 years	2 (7.1)
	Level of play (N=28)	Professional	25 (89.3)
		Semi-professional	3 (10.7)

N: number of valid responses for the item.

3.2. Coaches

Most coaches (80%) perceived the risk of SCA in football as moderate to very high, and 80% knew of SCA cases in football (Table 2). Practical preparedness, however, was limited: only 20% had been trained to recognise warning signs and provide initial management of SCA, 40% had never been trained and 40% expressed a need for training. No coach was regularly re-tested on emergency protocols, and 40% had never been tested. Preventive measures were absent in 50% of clubs, partial in 20% and structured in 30%. Although 90% of coaches considered ECG-based pre-participation screening essential (with reservations for one), nine of the ten clubs never had an AED available during training or matches. Most coaches (70%) felt that SCA incidents had a negative impact on the image and safety of football.

Table 2. *Perception of SCA risk, prevention and preparedness among coaches (n=10).*

Variable	Category	n (%)
Perceived SCA risk in football compared with other sports	Very high	1 (10)
	High	3 (30)
	Moderate	4 (40)
	Low	2 (20)
Knowledge of SCA cases in football	Yes	8 (80)
	No	2 (20)
Specific preventive measures in the club	Yes (structured)	3 (30)
	Partial	2 (20)
	None	5 (50)
Training in recognition and initial management of SCA	Yes	2 (20)
	No (never trained)	4 (40)
	Need for training	4 (40)
Review or testing on emergency protocols	Regularly	0 (0)
	Occasionally	5 (50)
	Rarely	1 (10)
	Never	4 (40)
ECG-based pre-participation screening is essential	Yes, absolutely	8 (80)
	Yes, with reservations	1 (10)
	No, not necessary	1 (10)

Variable	Category	n (%)
AED available during training and matches	Always	1 (10)
	Sometimes	0 (0)
	Never	9 (90)
Perceived impact of SCA incidents on the image and safety of football	Negative	7 (70)
	Positive	2 (20)
	Neutral	1 (10)

SCA: sudden cardiac arrest; ECG: electrocardiogram; AED: automated external defibrillator.

3.3. Medical Staff and Players

All three medical staff members reported being very aware of SCA risk, being able to identify its main risk factors, knowing specific management protocols and having received specific training in on-field SCA management, and all considered pre-competition ECG screening essential (Table 3). Nevertheless, two of the three worked without an AED during training and matches, and none selected a standard screening interval (annual, every season or every two years), all choosing "other".

Among players, 53.6% considered themselves very aware of SCA risk and 42.9% aware but not fully informed, and 71.4% knew of famous SCA cases. Only 35.7% could identify the main risk factors of SCA. Only 22.2% reported that their club ran ECG-based pre-participation screening, while 55.6% reported that it did not and 22.2% did not know. Although 96.3% considered regular cardiac examinations necessary, only 25.9% had received first-aid and AED training; most players wanted this training to be provided regularly (60.7%) or at the start of each season (35.7%). All players felt that SCA incidents affect the perception and safety of football, 48.3% "a lot".

Table 3. *Knowledge and preparedness for SCA among medical staff and players.*

Group	Item	Response	n/N (%)
Medical staff	Very aware of SCA risk in football	Yes	3/3 (100)
	Able to identify main SCA risk factors	Yes	3/3 (100)
	Knows specific SCA management protocols	Yes	3/3 (100)
	Received specific training in on-field SCA management	Yes	3/3 (100)
	Pre-competition ECG screening is essential	Yes, absolutely	3/3 (100)
	AED available during training and matches	Always	1/3 (33.3)
		Never	2/3 (66.7)
	Recommended frequency of cardiac examinations	Other (no standard interval)	3/3 (100)
Players	Awareness of SCA risk	Very aware	15/28 (53.6)
		Aware, not fully informed	12/28 (42.9)
		Not very aware	1/28 (3.6)
	Knows famous SCA cases in football	Yes	20/28 (71.4)
	Able to identify main SCA risk factors	Yes	10/28 (35.7)
		No	8/28 (28.6)
		Not sure	10/28 (35.7)
	Club runs ECG-based pre-participation screening	Yes	6/27 (22.2)
		No	15/27 (55.6)
		Does not know	6/27 (22.2)

Group	Item	Response	n/N (%)
	Players should undergo regular cardiac examinations	Yes, absolutely	26/27 (96.3)
		Only at the highest levels	1/27 (3.7)
	Received first-aid and AED training	Yes	7/27 (25.9)
		No	18/27 (66.7)
		Needs additional training	2/27 (7.4)
	Preferred frequency of first-aid/CPR training	Regularly	17/28 (60.7)
		At the start of each season	10/28 (35.7)
		Annually	1/28 (3.6)

N: number of valid responses for the item. SCA: sudden cardiac arrest; ECG: electrocardiogram; AED: automated external defibrillator; CPR: cardiopulmonary resuscitation.

4. Discussion

4.1. Gap Between Awareness and Operational Readiness

This study reveals a marked gap between awareness of SCA and operational readiness in Senegalese professional football, consistent across coaches, medical staff and players. Most respondents knew of SCA cases and acknowledged the risk, but only one in five coaches and one in four players had been trained, no coach was regularly re-tested on emergency protocols, and AEDs were almost never available at training or matches. The medical staff reported full training, yet two of the three worked without a defibrillator, so that their skills could not translate into early defibrillation. Players, who are often the first to reach a collapsed teammate, were largely untrained.

These findings matter because the time to defibrillation is the main determinant of survival. Ventricular fibrillation is the usual initial rhythm in exercise-related SCA, and defibrillation is its only definitive treatment [3]. Survival falls by about 7–10% for every minute without CPR and defibrillation, and by about 3–4% per minute when bystander CPR is provided [15, 16], and each minute of delay to the first shock reduces the probability of survival to hospital discharge by about 6% [17]; current recommendations therefore aim for an AED to be applied within three minutes of collapse [18]. In the FIFA Sudden Death Registry, survival was 85% when CPR was combined with an AED but only 35% without one [7], and high survival rates have been reported where on-site AED programmes and rehearsed emergency action plans exist [11, 19-21].

4.2. Comparison with Other African Settings

Our results closely mirror those recently reported in Cameroonian professional football, where knowledge of SCA was poor in about two-thirds of stakeholders, AEDs were rarely present at matches and generally absent at training sessions, and fewer than two in five participants knew of an emergency action plan [13]. One notable difference is that pre-season medical screening was common in Cameroon, whereas only 22.2% of Senegalese players reported ECG screening in their club. The near-total absence of AEDs probably reflects equipment costs, the lack of a regulatory obligation and limited awareness among club administrators, and it is consistent with the public statement of a Senegalese club physician after the death of a Ligue 1 captain in 2025 [14]. Such gaps are not confined to low-resource settings: in a recent survey of German amateur football clubs, only 30% had an AED and 10% a written emergency action plan for SCA [22]. That awareness did not translate into readiness suggests that information campaigns triggered by high-profile events are not sufficient without structural requirements.

4.3. Pre-participation Cardiovascular Screening

Support for pre-participation screening was almost unanimous (90% of coaches, all medical staff and 96.3% of players), but its implementation was limited, and the medical staff did not agree on any standard interval, which points to the absence of a national protocol. European recommendations include a 12-lead ECG in pre-participation evaluation [8, 9], and FIFA recommends an ECG at the start of a player's career and annually thereafter [10]. Screening can identify conditions such as hypertrophic cardiomyopathy before a fatal event [12], but it cannot eliminate risk: in a large cohort of English adolescent footballers, most players who later died of cardiomyopathy had had normal screening results [23]. Screening must therefore be combined with emergency preparedness. Black athletes also have a higher incidence of sudden cardiac death [6], and ECGs in athletes of African descent should be interpreted with the international criteria to limit false-positive results [24].

Implementing ECG-based screening in Senegal, however,

requires more than recording an ECG. Tracings must be interpreted by clinicians trained in athlete ECG interpretation, using the international criteria [24]. Even with modern criteria, an abnormal ECG is found in about 5% of athletes overall and 10% of Black athletes, compared with about 22% and 30%, respectively, under older European recommendations [25], and most of these findings are false positives. Every abnormal ECG must therefore lead to a predefined pathway: second-line investigations (transthoracic echocardiography first, then, when indicated, exercise testing, ambulatory ECG monitoring or cardiac magnetic resonance imaging), referral to a cardiologist with expertise in sports cardiology, and a shared decision on eligibility, temporary restriction or treatment [9, 24]. False-positive results cause anxiety, additional costs and possibly unjustified exclusion from play, whereas false-negative results remain possible [23]; screening therefore needs appropriately trained clinicians at each step. In the Senegalese setting, the limited availability of cardiologists trained in sports cardiology and of cardiac imaging, the cost of follow-up investigations and the absence of dedicated funding in most clubs are major constraints. The cost-effectiveness of ECG screening is still debated, and estimates from high-income countries (about US$42,900 per life-year saved in one United States model [26]) cannot be transposed directly. A feasible first step would be to screen Ligue 1 and Ligue 2 players through a programme coordinated by the federation's medical commission, with ECGs interpreted by a small network of trained cardiologists (possibly through tele-ECG), referral centres and the funding of follow-up tests agreed in advance, and an evaluation of costs and yield before any extension to lower divisions. Because an AED and a rehearsed emergency action plan protect every player, including those with normal screening results, these measures should be implemented alongside screening, not after it.

4.4. Knowledge and Training Needs

Players' knowledge was also superficial: although almost all reported being aware of SCA risk, nearly two-thirds could not identify its main risk factors. Education should cover warning symptoms (exertional syncope or chest pain, palpitations, unusual breathlessness), family history of sudden death and the cardiac risks of stimulant and doping products. Players' strong wish for regular training (96.4% wanting it regularly or at the start of each season) indicates that such programmes would be well received. Finally, the composition of the medical staff (one sports physician, no emergency physician or nurse) and the low response rate in this group may reflect a broader shortage of dedicated medical personnel in Senegalese clubs.

4.5. Limitations

This study has important limitations. The sample was small and recruited by convenience, which limits statistical power and generalisability; only 10 clubs were covered, and response rates were low among medical staff (3 of 10) and players (30 of 100), so that non-response bias is likely. Consequently, the results are not necessarily representative of all Ligue 1 and Ligue 2 clubs, or of Senegalese football as a whole, and should be regarded as exploratory. Data were self-reported and may be affected by social desirability, as suggested by the uniformly positive answers of the medical staff; no objective assessment of CPR or AED skills was performed. The questionnaires were pretested but not formally validated, some player items had missing responses, and the analysis was purely descriptive. Larger multi-centre studies including referees and club administrators, with objective skill assessment, are needed to confirm these findings.

5. Conclusions

This study documents critical shortfalls in cardiac arrest preparedness in Senegalese professional football: low CPR/AED training rates among coaches and players, near-total absence of AEDs, limited pre-participation screening and no standardised protocols, despite high awareness of the risk. Because these findings come from a small convenience sample, they should be confirmed by a nationwide assessment, covering all professional clubs and ideally amateur clubs, of written emergency action plans, AED accessibility (presence at training and matches, location, maintenance and time to retrieval) and CPR/AED training coverage; such real-world data would show the true level of preparedness and guide implementation. Although exploratory, the study provides a baseline for future research in sub-Saharan Africa and supports four priority recommendations for the Senegalese Football Federation and the professional league: (1) mandatory annual pre-participation cardiovascular screening including a 12-lead ECG interpreted according to international criteria by trained clinicians, with predefined referral pathways and funding for follow-up investigations; (2) CPR/AED training integrated into coaching licences, renewed regularly and extended to players, referees and club staff; (3) an AED and a written, rehearsed emergency action plan at every stadium and training ground, with medical cover at all matches; and (4) a national registry of sudden cardiac events in football. Addressing these gaps is essential to prevent avoidable deaths in African football.

Abbreviations

AED	Automated External Defibrillator
CNEPS	Centre National d'Éducation Populaire et Sportive
CPR	Cardiopulmonary Resuscitation
ECG	Electrocardiogram
FIFA	Fédération Internationale de Football Association

SCA	Sudden Cardiac Arrest
UEFA	Union of European Football Associations

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Author Contributions

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Djiby Guisse Diakhate: Conceptualization, Methodology, Supervision, Writing – review & editing

Data Availability Statement

The data are available from the corresponding author upon reasonable request.

Conflicts of Interest

The authors declare no conflicts of interest.

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